REMARKS

The Office Action of August 17, 2009, has been carefully studied. Claims 17, 20 and 22-34 currently appear in this application. These claims define novel and unobvious subject matter under Sections 102 and 103 of 35 U.S.C., and therefore should be allowed. Applicant respectfully requests favorable reconsideration and formal allowance of the claims.

What is Claimed

The presently claimed method provides a method for welding large three-dimensional objects having a variety of contours. Conventional rigid clamping devices that are adapted to contours are rather complicated and rather costly. Clamping devices that are not specifically designed for the particular contours to be welded do not permit a uniform clamping stress to build up on the contours to be welded, so that the welded articles will exhibit variations in the desired geometry, which will often exceed the acceptable tolerances.

The herein claimed method provides a homogeneous temperature in both the transmissive and absorptive join partner. By homogenizing the temperature on both sides of the welding level and rendering it more symmetric, the process window is expanded and the

process is less prone to malfunctions occasioned by irregular clamping fields, which is particularly important in welding articles with three-dimensional contours. In the herein claimed method, the clamping technique per se no longer constitutes the limiting factor in a three-dimensional welding process.

Rejections under 35 U.S.C. 112

Claims 17, 20, 22-24, 34 and 35 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

This rejection is respectfully traversed.

The claims have been amended in accordance with the Examiner's helpful suggestion, in which the eradiation is defined as "laser welding beam." Additionally, the claims have been amended to clarify that the secondary radiation source is different from a laser.

Art Rejections

Claims 17, 20, 22, 23, 34 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Savitski, US 2002/0100540 in view of Nishio, JP 64-12081.

This rejection is respectfully traversed.

Savitski is concerned with butt-welding, not with through-welding with laser-transmissive and laser-absorptive join partners. Savitski merely discloses butt-joining of two tube parts 42 by means of a sleeve part 40. In Savitski, the sleeve 40 is an auxiliary part within the connection between the two parts. This is not the same with the herein claimed process. Nishio merely discloses that the secondary radiation in butt welding with a laser is infrared radiation.

The method claimed herein is directed to contour-welding of three-dimensional thermoplastic molded articles. No auxiliary work pieces are required, as the laser-transmissive join partner is placed directly on top of the laser-absorptive join partner. The contour welding of three-dimensional molded articles is far more complex than butt-welding in which a sleeve is passed over the two parts to be joined to hold them in place.

A typical example of contour welding as claimed herein is welding of tail-lamp units for vehicles, which consists of a cup-shaped inner housing (absorptive join layer) and the light-transmissive cover. The light-transmissive cover must have a certain coloring because the tail-lamps must be red, and this member must also have certain mechanical

specifications. Accordingly, the contour-welding of such three-dimensional thermoplastic bolded articles is far more sophisticated that butt or lap joints disclosed by Savitski or Nishio.

Savitski need not struggle with the problems encountered in contour welding of three-dimensional molded articles, which is the narrow process window for the control of the laser beam energy. Some of these problems are highlighted in the specification as filed, beginning at page 3, line 26. That is, many of the thermoplastic components to be contour welded have a very small temperature difference between their melting temperature and their decomposition temperature. The plastic materials often plasticize at high temperatures so that the welding process depends on heat conductivity that can only be implemented at high cycle times. The required close range of temperatures requires narrow process windows which present an obstacle to laser welding of three-dimensional molded articles.

The presently claimed process solves these problems that are unique to three-dimensional contour welding by irradiation of the other join partner, that is, the "top layer" of the welding area, thus homogenizing the temperature field at the welding field on both sides of the welding

temperature range, so that the clamping technique is not required for this type of welding.

Savitski does not give any rationale for perfecting the radiation into the welding partners, and thus one skilled in the art, reading Savitski, would not be motivated to use more than one type of radiation for forming a weld joint.

It is respectfully submitted that Nishio actually **teaches away** from the herein claimed process.

First of all, Nishio already does not deal with welding of thermoplastic molded articles, let alone with the through-welding of laser-absorptive and laser-transmissive join partners. Rather, Nishio discloses butt welding of metal pieces 3a, 3b, by means of a laser beam transmitted to the butt part of the two pieces from one side. This is not even welding of thermoplastic components, as Nishio shows a metal hatching at pieces 3a and 3b and talks of crystal grains, which is typical of metallurgical effects. In fact, one would not expect the presence of crystal grains in a thermoplastic material.

Because Nishio deals with welding metal, there is nothing in Nishio regarding solving the problem of the narrow process window which is required for through-welding thermoplastic parts

As can readily be seen from the figure and abstract of Nishio, both metal pieces 3a and 3b are simultaneously melted in the butt part 6. Thus, there is no heat transfer from one piece to the other which is critical for the herein claimed process.

The infrared lamps 7 in Nishio irradiate both pieces 3a and 3b, and thus do not selectively influence the temperature field in one of the work pieces, as is required in the herein claimed process. Moreover, the Nishio infrared lamps are clearly disclosed to control the **cooling speed** to prevent crystal grains form being coarsened within the welding area. This is a typical metallurgical effect and has nothing to do wit the selective application of laser-transmissive join partner to homogenize the temperature field between the two join partners, as claimed herein. Again, the temperature field of Nishio is already symmetric because of the identical nature of both work pieces 3a and 3b and the symmetrical radiation of the laser into the base part 6.

That is, Nishio does not at all disclose the additional and simultaneous exposure of the laser-transmissive join partner in the welding area to an electromagnetic secondary IR or UV radiation such that the temperature field in the welding area is homogenized.

Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Savitski, Nishio, and further in view of either one of Chen et al., US 20030213552 or Itagaki, JP 58-163587.

This rejection is respectfully traversed.

As noted above, Savitski only deals with butt-welding of two tube parts. This is a quite different procedure from contour welding of three-dimensional articles, and Savitski requires a sleeve for connecting the two pipes. This is not the case in the presently claimed method. Savitski gives no reason for perfecting the radiation into the welding partners and one skilled in the art would not be led to use more than one radiation source. Nishio adds nothing to Savitski, because Nishio uses infrared lamps to control the cooling speed of two identical metal components, not the temperature of the welded area to ensure even welding.

Even if one skilled in the art were to combine Itagaki or Chen with Savitski and Nishio, one would not arrive at the herein claimed process. A combination of Savitski, Nishio and Itagaki or Chen would yield a welding process requiring an auxiliary member (sleeve) to butt weld together two tubes, using infrared radiation to control the process at which the welded article closed. The fact that Chen or Itagaki discloses welding

using a transparent roller or clamp still does not lead one skilled in the art the presently claimed process, because there is no method for maintaining a homogeneous temperature within the welding site without the use of an auxiliary means to weld the pieces together. Moreover, welding a three-dimensional contoured article is far more complex than butt-welding two tubes together in which a sleeve holds the two tubes together.

In view of the above, it is respectfully submitted that the claims are now in condition for allowance, and favorable action thereon is earnestly solicited.

Respectfully submitted,

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